ENGLISH TRANSLATION

# 79 GHz BAND HIGH-RESOLUTION RADAR

# ARIB STANDARD

## ARIB STD-T111 Version 1.1

Version 1.0 December 18th 2012
Version 1.1 March 24th 2017

Association of Radio Industries and Businesses

## General Notes on the Translated Version of ARIB Standard in English

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# Introduction

With participation of radio equipment manufacturers, telecommunications operators, broadcasting equipment manufacturers, broadcasters and general users, et al., Association of Radio Industries and Businesses (ARIB) assembles “ARIB Standards” each of which defines basic technical and relevant requirements on a radio equipment, etc. for a variety of radio system applications.

An ARIB Standard is an industrial standard based on relevant compulsory national standards of Japan which coordinate the effective use of radio frequency spectrum and the mitigation of interferences with other spectrum users, and formulated by combining voluntary standards in public intended to provide the assured quality and compatibility of radio and broadcasting equipments and thus to enhance conveniences for radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasting operators, and general users et al.

The ARIB standard described herein is for “79 GHz BAND HIGH-RESOLUTION RADAR”. In order to ensure fairness and transparency in its assembly process, the standard has been established by consensus of the ARIB standard council with the participation of interested parties who represent radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasting operators, and general users et al., both domestically and overseas.

It is highly expected that this ARIB standard serves as guidance and reference to all the interested parties including radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasting operators, and general users et al.

NOTE: Although this ARIB Standard contains no specific reference to any Essential Industrial Property Rights relating thereto, the holders of such Essential Industrial Property Rights state to the effect that the rights listed in the List of Essential Industrial Property Rights, which are the Industrial Property Rights relating to this ARIB STD-T111 standard, are held by the parties also listed therein, and that to the users of this standard, in the case of selection of Option 1, such holders shall not assert any rights and shall unconditionally grant a license to practice such Industrial Property

Rights contained therein, and in the case of selection of Option 2, the holders shall grant, under reasonable terms and conditions, a non-exclusive and non-discriminatory license to practice the Industrial Property Rights contained therein. However, this does not apply to anyone who uses this ARIB Standard and also owns and lays claim to any other Essential Industrial Property Rights covered in whole or part in the contents of the provisions of this ARIB Standard.

# Contents

Amendment History

# Chapter 1 General Description

## 1.1 Overview

This ARIB Standard (referred to as this "Standard") sets forth provisions concerning a radio equipment (referred to as "79 GHz Band High-Resolution Radar") for millimeter wave radar (radar that uses radio waves in a millimeter band for radiolocation service) that uses radio waves in the band from 77 GHz to 81 GHz under the definition of the specified low-power radio stations designated in Article 6, Paragraph 4, Item 2 of the Regulations for Enforcement of the Radio Law. Pursuant to Ministry of Internal Affairs and Communications (referred to as "MIC").

## 1.2 Scope of this ARIB Standard

The radio equipment for 79 GHz band high-resolution radar consists of a transmitter, a receiver, antennas, a controller, a signal processing unit, and a power supply unit, as indicated in Figure 1-1. This ARIB Standard specifies technical requirements on this radio equipment.

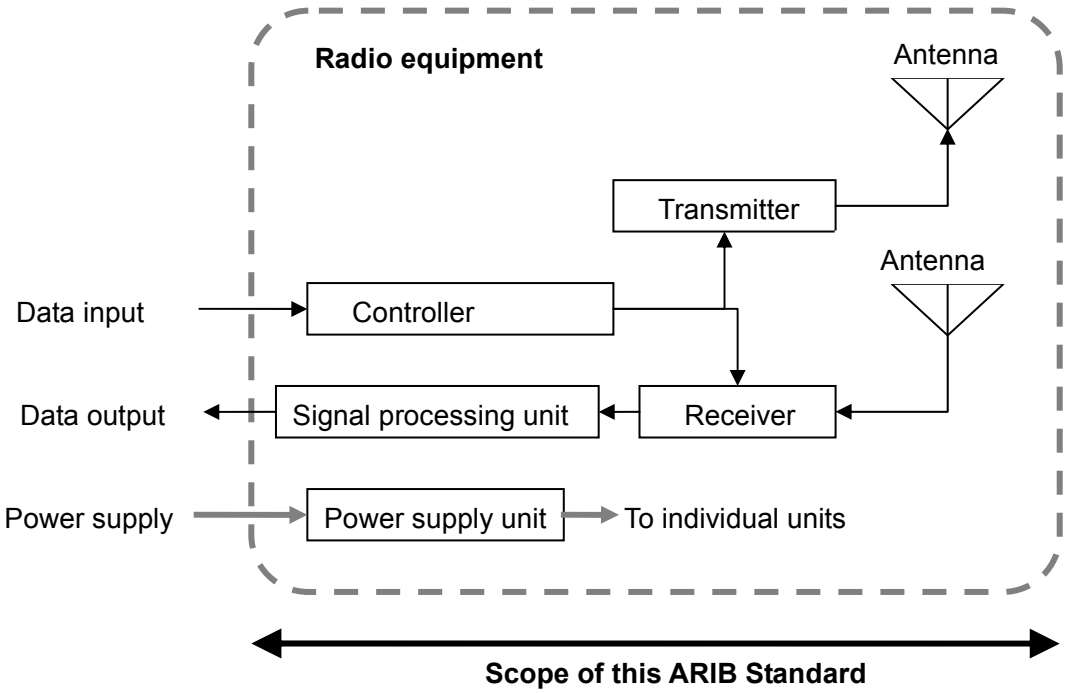


Figure 1-1 Composition of Radio Equipment

## 1.3 Normative references

In this ARIB Standard, “RERL” refers to the Regulations for Enforcement of the Radio Law, “ORE” refers to the Ordinance Regulating Radio Equipment, “OTRCC” refers to the Ordinance concerning Technical Regulations Conformity Certification, etc. of Specified Radio Equipment, and “NT” refers to a Notification of the Ministry of Internal Affairs and Communications.

# Chapter 2 Standard Systems Using the Radio Equipment

## 2.1 Standard system configuration

Not specified

## 2.2 Use Cases of standard systems

No specific methods of operating standard systems are prescribed.

The following cases of usage of the standard systems are provided only for reference.

(1) Detection of vehicles or pedestrians while driving

Operating formats whereby a radio equipment is installed in a host vehicle to detect other vehicles or pedestrians that are present in the host vehicle's moving direction or that may enter the host vehicle's line of movement

(2) Detection of vehicles or pedestrians when making turns at intersections

Operating formats whereby a radio equipment is installed in a host vehicle to detect other vehicles or pedestrians that are in an intersection or that may enter the intersection when the host vehicle is turning at the intersection

(3) Detection of motorcycles

Operating formats whereby a radio equipment is installed in a host vehicle to detect motorcycles that are present in the host vehicle's moving direction or that may enter the host vehicle's line of movement

(4) Detection of vehicles or pedestrians by roadside equipment

Operating formats whereby a radio equipment is installed on the roadside to detect vehicles or pedestrians present in the vicinity of an intersection

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# Chapter 3 Technical Requirements on the Radio Equipment

This chapter includes governmental technical regulations (compulsory standards) and voluntary industrial standards. The underlying laws and articles of provisions are referred to for the governmental technical regulations.

## 3.1 General requirements

### 3.1.1 Radar format

Not specified

### 3.1.2 Type of Radio waves

Not specified

### 3.1.3 Frequency (ORE, Table 1, Note 34, NT No. 507 of 2011, NT No.432 of 2016)

The designated frequency and designated frequency band are as indicated in Table 3-1.

**Table 3-1 Designated Frequency and Designated Frequency Band**

| Designated frequency | Designated frequency band |
|---|---|
| 79.0 GHz | From 77.0 GHz to 81.0 GHz |

## 3.2 Transmitter

### 3.2.1 Antenna power (RERL, Article 4-4, Paragraph 2, Item 6), (RERL Article 6, Paragraph 2(11), NT No.42 of 1989, NT No.430 of 2016)

The antenna power shall be 10 mW or less on average; provided, however, that in cases where the occupied bandwidth is 2 GHz or less, the average power in a 1 MHz bandwidth shall be 5 μW or less.[1]

### 3.2.2 Antenna power tolerance (ORE, Article 14, Paragraph 1, Table 9)

The tolerance of the antenna power shall be 50% in the upper limit and 70% in the lower limit.

### 3.2.3 Frequency tolerance (ORE, Article 5, Table 1, Note 34(2))

The frequency shall be within the designated frequency band.

### 3.2.4 Permissible value of occupied bandwidth (ORE, Article 6, Table 2, No. 28, NT No.659 of 2006, NT No.431 of 2016)

The occupied bandwidth shall be equal to or less than 4 GHz.

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[1] Average power of 5 μW or less in a 1 MHz bandwidth means that the total average power is no more than the value of the occupied bandwidth expressed in MHz unit multiplied by 5 μW.

### 3.2.5 Permissible levels of unwanted emission intensity (ORE, Article 7, Table 3, No. 57)

The permissible levels for unwanted emission intensity shall be as indicated in Table 3-2.

**Table 3-2 Permissible Levels of Unwanted Emission Intensity**

| Frequency Range | Permissible Level of Unwanted emission Intensity |
|---|---|
| Out-of-Band | Peak power of 100 μW or less in any arbitrary 1 MHz bandwidth |
| Spurious | Peak power of 50 μW or less in any arbitrary 1 MHz bandwidth |

By way of reference, the frequencies of the out-of-band and the spurious band for the designated frequencies from 77 GHz to 81 GHz are as indicated in Table 3-3.

**Table 3-3 Frequency Bands for the Out-of-Band Range and the Spurious Range**

| Frequency Range | Frequency Band |
|---|---|
| Out-of-Band | Higher than 72.5 GHz, lower than 77.0 GHz |
| | Higher than 81.0 GHz, lower than 85.5 GHz |
| Spurious | 72.5 GHz and lower |
| | 85.5 GHz and higher |

## 3.3 Receiver

### 3.3.1 Limit on incidentally produced emissions (ORE, Article 24, Paragraph 13, Item 2)

The limit on incidentally produced emissions shall be as set forth in Table 3-4.

**Table 3-4 Limit on Incidentally Produced Emissions**

| Frequency Range | Limit on Incidentally produced Emissions |
|---|---|
| Out-of-Band | Peak power of 100 μW or less in any arbitrary 1 MHz bandwidth |
| Spurious | Peak power of 50 μW or less in any arbitrary 1 MHz bandwidth |

## 3.4 Controller

### 3.4.1 Interference prevention function (RERL, Article 6-2, Item 5; ORE, Article 9-4, Item 7)

The radio equipment shall have a function to distinguish its own transmitting signals from radio waves transmitted by other radio stations, by identifying their modulation methods or other characteristics.

### 3.5 Antenna

#### 3.5.1 Antenna structure

Not specified

#### 3.5.2 Antenna gain (ORE, Article 49-14, Item 13 (b))

The absolute gain of the transmission antenna shall be 35 dB or less.

#### 3.5.3 Antenna polarization

Not specified

#### 3.5.4 Antenna configuration

Not specified. Therefore, the transmitting antenna and the receiving antenna may be separate.

### 3.6 Housing (ORE, Article 49-14, Item 13(a))

The radio equipment shall be contained in a single-unit housing that cannot be opened easily. This requirement, however, does not apply to the antenna(s).

### 3.7 Marking in relation to technical regulations conformity certification (OTRCC, Article 8 & Article 20)

Marking shall be made in one of the following ways to indicate certifications of the "radio equipment conformity to the technical regulations" or of the "construction design".

- Physical marking in the specified format, attached in a highly-visible area of the radio equipment.
- Electronic method by which the marking in a specific format is recorded in an electronic or magnetic means within a radio equipment and can be displayed immediately and clearly with pre-determined operating steps.[2]

[2] A statement of adopting the electronic marking should be clearly provided either in a document attached to the radio equipment or in other proper manner, together with an explanation of the pre-determined operating steps for displaying the label.

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# Chapter 4 Measurement Methods

This chapter specifies measurement methods for confirming that the technical requirements for the radio equipment in Chapter 3 are satisfied. The measurement methods conform to "TELEC-T319: CHARACTERISTIC TEST METHOD FOR SPECIFIED LOW-POWER RADIO EQUIPMENT FOR MILLIMETER WAVE RADAR (79 GHz band)" (referred to as "TELEC-T319").

However, when other measurement methods are specified by Notifications of the MIC or the like, those measurement methods or their alternatives with at least equivalent quality shall be applied.

## 4.1 Transmitter

### 4.1.1 Frequency Tolerance

The measurement method shall comply with Section "Frequency error and occupied bandwidth" in "TELEC-T319".

### 4.1.2 Occupied Bandwidth

The measurement method shall comply with Section "Frequency error and occupied bandwidth" in "TELEC-T319".

### 4.1.3 Antenna power tolerance

The measurement method shall comply with Section "Antenna power error" in "TELEC-T319".

### 4.1.4 Permissible levels of unwanted emission intensity

The measurement method shall comply with Section "Spurious and unwanted emission intensity" in "TELEC-T319".

## 4.2 Receiver

### 4.2.1 Limit on Incidentally produced emissions

The measurement method shall comply with Section "Limit of secondary radiated emissions" in "TELEC-T319".

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# Chapter 5 Nomenclature

Terms used in this ARIB Standard shall have the following definitions.

Occupied Frequency Bandwidth

The frequency bandwidth defined by a upper frequency limit and a lower frequency limit for which the amounts of average power radiated above the upper limit and below the lower limit constitute 0.5% of the total average power emitted, respectively. (RERL, Article 2, Item 61)

Out-of-Band Frequency Range

A frequency band outside the occupied bandwidth, where out-of-band emission dominates (RERL, Article 2, Item 63-5)

Spurious Frequency Range

A frequency band where spurious emission dominates outside the out-of-band frequencies (RERL, Article 2, Item 63-4)

Unwanted Emission

Spurious emission and out-of-band emission (RERL, Article 2, Item 63-3)

Permissible Levels of Unwanted Emission Intensity

With respect to the transmitter of a radio station for radiolocation service, the permissible peak power of unwanted emission at each frequency during normal operation of the transmitter (OTRCC, Table 3, No. 1(2)).

Amendment History

(ARIB STD-T111)

The 1.1th edition amendment history

<table>
<tr><th>Page</th><th>Para. No.</th><th>Content of Amendment</th><th>Present</th><th>Reason</th></tr>
<tr><td>i</td><td>Con tents</td><td>3.2.4 Permissible value of occupied bandwidth</td><td>3.2.4 Permissive value of occupied bandwidth</td><td>Correction</td></tr>
<tr><td>1</td><td>1.1</td><td>1.1 Overview<br>Deleted present sentence</td><td>1.1 Overview<br>Notification No. 443 of 2012, however, the designated frequency band is limited to 78 GHz to 81 GHz.</td><td rowspan="4">Change related to NT No. 430, 431, 432 of 2016</td></tr>
<tr><td>5</td><td>3.1.3</td><td>3.1.3 Frequency<br>(ORE, Table 1, Note 34, NT No.507 of 2011, NT No.432 of 2016)<br><br>(snip)<br>Table 3-1 Designated Frequency and Designated Frequency Band
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<tr><td>5</td><td>3.2.1</td><td>3.2.1 Antenna power<br>RERL, Article 4-4, Paragraph 2, Item 6~~;~~, (RERL Article 6, Paragraph 2(11), NT No.42 of 1989, NT No.430 of 2016)</td><td>3.2.1 Antenna Power<br>(RERL, Article 4-4, Paragraph 2, Item 6; NT No. 421 of 2012) ,</td></tr>
<tr><td>5</td><td>3.2.4</td><td>3.2.4 Permissible value of occupied bandwidth</td><td>3.2.4 Permissible value of occupied bandwidth</td></tr>
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<td>(ORE, Article 6, Table 2, No. 28; NT No.432 of 2012)<br><br>The occupied bandwidth shall be equal to or less than 3 GHz</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3.2.5</td>
<td>3.2.5 Permissible levels of unwanted emission intensity<br>(ORE, Article 7, Table 3, No 57)<br>(snip)<br>By way of reference, the frequencies of the out-of-band and the spurious band for the designated frequencies from 77 GHz to 81 GHz are as indicated in Table 3-3.<br><br>Table 3-3 Frequency Bands for the Out-of-Band Range and the Spurious Range
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</td>
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|---|---|---|---|---|
| 6 | 3.4.1 | 3.4.1 Interference prevention function (RERL, Article6-2, Item5, ORE, Article 9-4, Item 7) | 3.4.1 Interference prevention function (RERL, Article6-2, Item5, ORE, Article 9-4, Item 8) | Change related to law correction |
| 6 | 3.5.2 | 3.5.2 Antenna gain (ORE, Article 49-13(b)) | 3.5.2 Antenna gain (ORE, Article 49-14(b)) | |
| 6 | 3.6 | 3.6 Housing (ORE, Article 49-13(a)) | 3.6 Housing (ORE, Article 49-14(a)) | |

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# Communication Note of ARIB Standard-related Proposals

| | | | |
|---|---|---|---|
| ARIB Standard Name (No.) | 79 GHz BAND HIGH-RESOLUTION RADAR (ARIB STD-T111) | | |
| Sections to be completed by sender | | | |
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| TEL: | FAX: | E-mail: | |
| Company/Organization Department | | | |
| Page / Section | (Please describe your proposal or present your questions or comments in concrete terms.) | | |
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| | | Remarks | |

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